

## **Driving, Walking, and Where You Live: Links to Obesity**

A report on new research being published in the *American Journal of Preventive Medicine*, "Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars"

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### **Executive Summary**

This study shows a strong link between time spent driving and obesity: every additional 30 minutes spent in a car each day translates into a 3 percent greater chance of being obese. The same study finds that people who live in neighborhoods with a mix of shops and businesses within easy walking distance are 7 percent less likely to be obese, lowering their relative risk of obesity by 35 percent. An average white male living in a compact community with nearby shops and services is expected to weigh ten pounds less than a similar white male living in a low density, residential-only cul-de-sac subdivision.

The paper, "Obesity Relationships with Community Design, Physical Activity and Time Spent in Cars" to be released by the peer-reviewed *American Journal of Preventive Medicine* in June, is the first to document an association between land use, weight, and travel behavior at the neighborhood level using objective land use data. The study tracked the body mass index and travel behavior of more than 10,500 people in the Atlanta region while assessing the types of neighborhoods where they lived. This report puts the study's findings into terms that are easier for non-scientists to understand.

The community design factor most strongly associated with a lower probability of obesity was living in a neighborhood with shops, businesses, and a range of services. The study also looked at other factors in the environment that may affect weight and health, including the connectivity of the street network (how many through streets offer alternative routes) and residential density. Both of these factors were associated with lower body mass index levels or weight. The study controlled for age, income, and education, and found significant differences in obesity levels by ethnicity and gender. The main findings held true for all groups.

The paper suggests that tripling the number of shops and other businesses near homes could have the same effect on obesity levels as magically making everyone in Atlanta 5 years younger. Even with this change, the number of development parcels dedicated to business uses would be less than ten percent of the number of plots devoted to homes.

The physical activity measures in the study -- time spent driving (a sedentary behavior) and distance walked (being physically active) also had a significant impact on obesity levels. People were less likely to drive and more likely to walk if they lived within walking distance of businesses. But most study respondents did not walk much, and many reported spending a lot of time in the car. Over 90 percent reported no walking at all, and the average time spent in a car was more than one hour per day.

Findings from the study further suggest that distance walked and time spent driving reported by white Atlantans is more closely related with urban form than it is for black Atlantans. On average, black people report walking more and driving less than whites, however, the amount of walking and driving for blacks does not appear to be as closely related with urban form.

This paper is an outgrowth of a larger study of land use and travel patterns in Atlanta known as SMARTRAQ, sponsored by the Centers for Disease Control and Prevention, the Georgia Department of Transportation, and the Georgia Regional Transportation Authority, and the Environmental Protection Agency. The study's primary author is Larry Frank, now Associate Professor at the University of British Columbia. Dr. Frank was at Georgia Tech during most of the study. Co-authors are Dr. Tom Schmid of the national Centers for Disease Control and Prevention and Martin Andresen, a doctoral student in Geography at the University of British Columbia. The editors of the *American Journal of Preventive Medicine* and the publisher Elsevier have agreed to allow the article to be released early for the Time-ABC News Obesity Summit. It will appear in print in August.

## **Introduction: Why this study is important**

As the United States looks for ways to fight the obesity epidemic, public health officials and others are paying more and more attention to increasing physical activity as a part of daily life. A greater emphasis on such 'active living' could result in significant health improvements, especially for those who are currently inactive or sedentary. For instance, one estimate predicts that cardiovascular disease, type II diabetes, colon cancer and other diseases associated with obesity could be reduced by almost one-third if the most inactive people were to become more active.

Research is starting to show that where you live matters when it comes to getting enough physical activity. A national study by Reid Ewing of the University of Maryland released in August 2003 found that people who lived in the most sprawling environments walked less and were more likely to be overweight, obese, and to have high blood pressure. The study attributed the findings to the inability of people in highly sprawling environments to get much physical activity in daily life through walking or bicycling. The study served as a broad national scan, using existing national land use and health data and looking at health impacts only on a county level. Since most walkability varies considerably from one neighborhood to the next, the Ewing study lacked an important level of detail. The study described in this report moves those general national findings to the next level, by looking closely at possible connections between study participants' immediate neighborhood and their health. It also provides new information about the impact of driving on health.

In addition, this study controlled for differences in income, and analyzed the results by ethnicity and gender. The researchers weighted the study in order to gain a sample and results that are representative of the Atlanta region as a whole, but the findings can be generalized to other urban environments within the United States.

The peer-reviewed study on which this report is based, "Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars" is being published in the *American Journal of Preventive Medicine*. The study is but one piece of a much larger long-term research project in Atlanta known as "SMARTAQ", which is examining how neighborhood form influences travel patterns, air pollution and other factors. SMARTAQ is one of the largest such research efforts in the country and represents a unique partnership between professionals

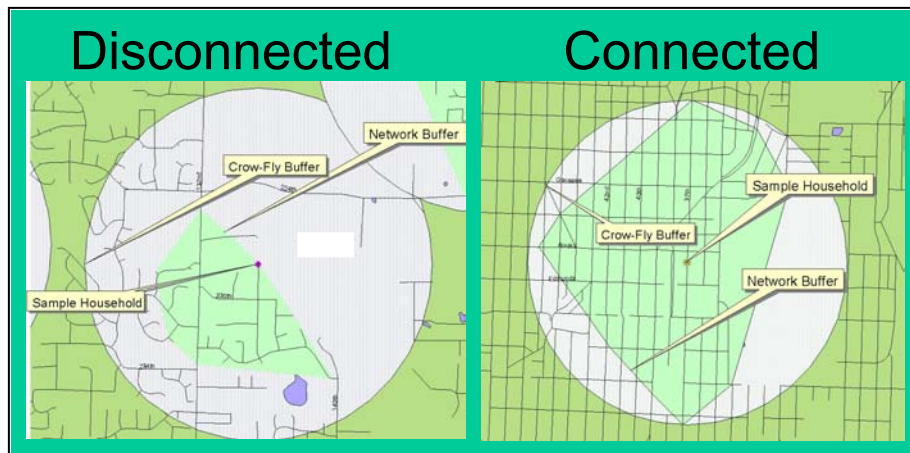
in transportation engineering, urban planning, environmental interests, and public health.

## How the study was conducted

### *Measuring urban form around where people live*

The researchers focused on the travel habits of 10,858 people in the Atlanta region through a travel survey conducted by the Atlanta Regional Commission conducted in 2001 and 2002, and took a close look at the environment immediately surrounding their homes. Each survey participant began by filling out a survey giving their gender, ethnicity, household income, age, and education. They also gave their weight and height, which were used to calculate Body Mass Index (BMI), a measure of weight in relation to height.

**Figure 1: Measuring connectivity**



For each household participating in the survey, the researchers looked at the surrounding street network and determined the area within a one-kilometer walk of the home. This area may be considerably smaller than a one-kilometer 'crow-fly' distance, because of the limitations of the street network. In transportation research this area is called the 'network buffer.' See figure 1.

Once the network buffer was determined, the researchers evaluated the characteristics of this area according to three common measures of walkability: connectivity, residential density, and the mix of non-residential destinations.

- **Connectivity** simply looks at how many of the streets connect to each other and provide direct pathways to nearby destinations. People will generally not walk far and dislike to

take indirect routes, so a higher level of connectivity is expected to result in more walking and ultimately perhaps in less obesity. Typical suburban neighborhoods with few through-streets have lower connectivity, while grid street patterns have more.

- **Net residential density.** Research shows that when people live closer together more people walk to transit stops or other destinations. However, densities do not have to be particularly high to achieve this affect: single-family homes on quarter-acre lots can be sufficient to support a transit system, if the neighborhood has sidewalks and good connections. The net residential density is determined through the Census Block group, which is an area that captures about 1000 households.
- **Land use mix:** how many stores, offices, or institutions are within walking distance? This was determined by creating a land use mix scale, with zero representing a purely residential area, and one representing an area with a perfectly even balance of homes, shops, offices, and institutions. In Atlanta, the average mix was .15, and the maximum mix was .64. The information for this calculation came from the county tax assessor data. Many studies have found that when people live close to more destinations, they are much more likely to walk to accomplish their daily activities, which results in more physical activity.

*Measuring travel behavior and health of study participants*

The researchers looked at the travel behavior of the 10,898 study participants to determine whether they were getting physical activity through walking, and how much time they spent driving or riding in a car, which is a sedentary activity. The participants filled out a travel diary for two days, showing where and how they traveled.

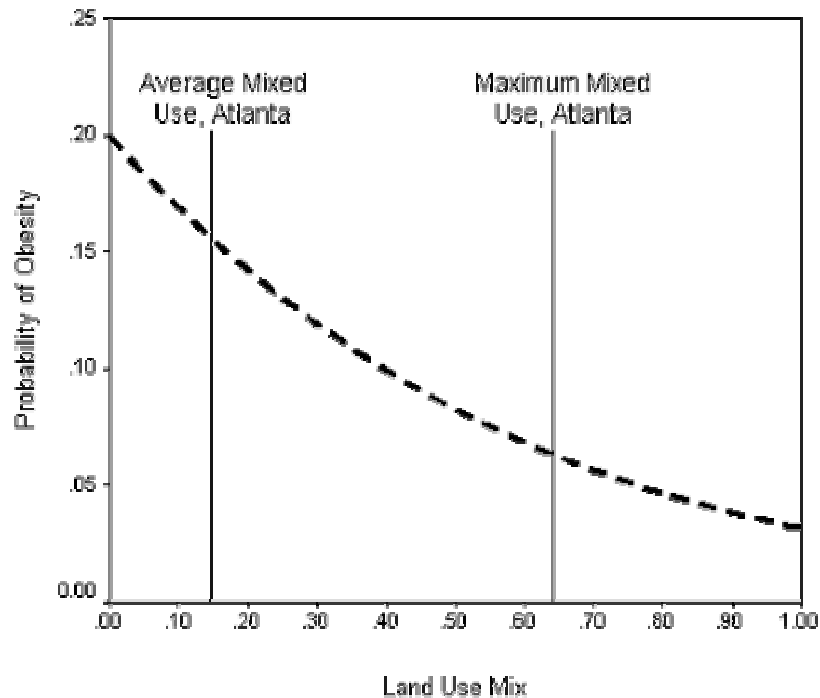
Researchers used GIS-based maps to calculate the actual distance and time for each trip in order to come up with the measures of distance walked or time spent in a car as either a passenger or driver. Traffic congestion was taken into account by using expected travel times calculated by the regional travel model.

All of these data were combined into a model to find out if neighborhood characteristics or travel behavior were linked to the probability of being obese. The researchers also assessed how these links differed based on ethnicity or gender. The study also controlled for age, income, and education, all of which have an independent impact on weight and obesity.

**Findings: Residents of balanced neighborhoods are less likely to be obese**

The most significant design factor related to the probability of being obese was the amount of shops, offices, and other varied destinations within walking distance of home. A change in the land use mix from 0 (all homes) to .25 (primarily homes, with a few shops or services close to home) decreased the probability of obesity by 7 percent. For individual residents, this meant their relative chance of being obese dropped 35 percent. In figure 2, you can see how the probability of obesity dropped as land use mix increased. The proportion of obese people in the least mixed neighborhoods is about 20 percent, while in the most mixed neighborhoods about 15 percent of residents are obese.

**Figure 2: The probability of obesity falls in balanced neighborhoods**



Another way to look at the results is to divide the respondents evenly into quarters, and look at the chance of obesity in these quartiles. Those who lived in the most homogenous (all housing) neighborhoods were 12 percent more likely to be obese than the quarter who lived at the next level of mix, and 24 percent more likely to be obese than the 3<sup>rd</sup> quartile, who lived in neighborhoods with more shops, offices, and institutions nearby. The differences are quite significant if you compare residents in the first and 4<sup>th</sup> quartiles. An average white male (height 5'10") living in a compact community with nearby shops

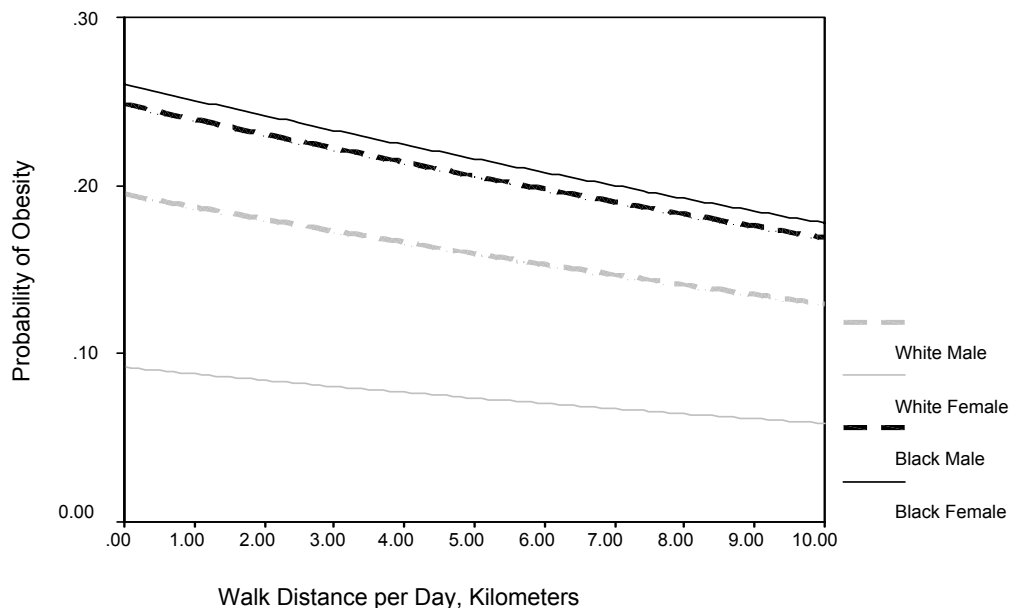
and services weighs ten pounds less than a similar white male living in a low density, residential- only cul-de-sac subdivision.

One of the remarkable aspects of this study is that the highest level of mix in the Atlanta region is far below that available in many other American cities, yet these very strong associations were still found. The associations held true across all four racial and gender categories studied, but the results appear to suggest that the gap between whites and blacks and men and women decreases as the degree of mix increases.

### Findings: Walking, Car Time, and Obesity

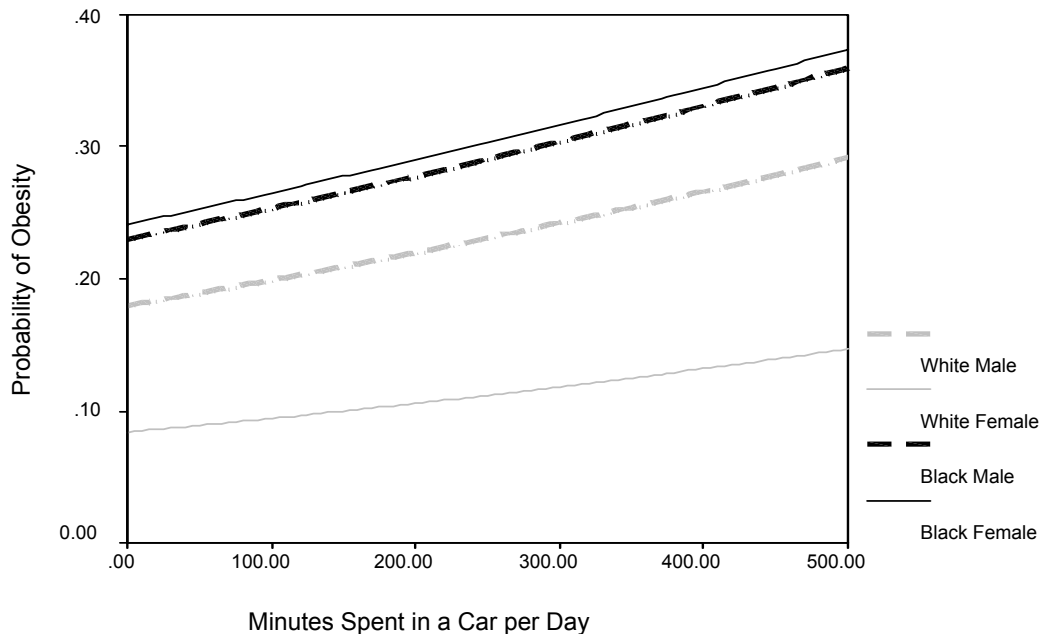
The distance people walked was a significant factor linked to the likelihood of being obese. For the average study participant, each kilometer walked – just over a half mile - translated into an almost 5 percent reduction in the probability of being obese. The association was roughly the same for black and white men and black women and slightly less strong for white women (see figure 3). The average distance walked among those who reported walking was around 2.5 kilometers a day. Only a few respondents reported walking long distances: 544, or 5 percent, reported walking more than one kilometer in a day. Most respondents – 91 percent – did not report walking at all during the two-day study period.

**Figure 3:**  
***The probability of obesity falls as people walk more***



Time spent in a car had the opposite relationship with obesity: the more time people spent in cars, the more likely they were to be obese. For survey respondents, every additional half hour spent driving translated into a three percent greater probability of being obese. See figure 4. The average time spent driving across the entire survey was more than an hour; 31 percent spent more than an hour and a half a day in a car and 648 people spent more than five hours a day in a car.

**Figure 4: The probability of obesity rises with time spent in a car.**



People were less likely to drive and more likely to walk if they lived in neighborhoods with a mix of uses. The study also found that Atlantans who live in more mixed neighborhoods are less likely to be obese, even when the amount of driving and walking was taken out of the equation. It is not clear what else about land use mix is linked to obesity, but one possibility is access to good food choices. Other research has found that poorer areas of cities have fewer restaurants and grocery stores that serve healthy foods. The degree of land use mix may also be inadvertently capturing the availability of healthy food choices near home. This issue should be addressed in future research.

### **Findings: Ethnic and Gender Differences**

While the three basic findings -- that the probability of obesity is related to neighborhood mix, the distance walked, and time spent in an automobile -- held true across all racial and ethnic groups, other findings varied by ethnicity and gender. The results suggest that



travel patterns and weight will likely vary with mix, density, and connectivity more for white people than for black people, all else being equal. Greater mix, higher density, and more connectivity were associated with a lower Body Mass Index for whites, but not for blacks. White men showed the greatest degree of change in walking, driving, and body mass index (weight) in different levels of density, mix, and street connectivity. In all cases, the researchers took into account the differences in weight and obesity that are associated with age, education, and income.

When the researchers looked at whether neighborhood characteristics were directly linked to how far people walked, they found this relationship was stronger for white Atlantans than black Atlantans. For white men and women, a more balanced mix of land uses, greater street connectivity, and higher residential density all were linked to longer distances walked. For black women, land use mix and connectivity were significant. But the researchers found no relationship between the distance black men walked and the urban form in their neighborhoods. Overall, blacks report more walking more than whites for utilitarian purposes.

Conversely, white Atlantans spent more time in cars than black Atlantans, and the amount they drive is more influenced by neighborhood characteristics. The researchers found that white people living in neighborhoods with a more even mix, greater residential density, and more street connectivity were less likely to spend a lot of time in a car. For black women, only higher connectivity and density were linked to less car time, and for black men, only higher density was linked to less car time.

### *Study Limitations*

This study has five principle limitations that should be addressed in future research. First there is a potential for non-response. As noted above this study had an overall response rate of 30.4%, however with a sample of more than 10,000 participants we hope this potential for bias had been mediated. Second, we rely on self-reported height and weight to calculate BMI. Third, as noted, Atlanta Georgia has a limited range of urban form. Future research on obesity and the built environment should be undertaken in geographical areas with greater urban form diversity. Fourth, the study did not consider the effects of time associated with transit use, which usually involves walking, or the relationship between transit service, walking, and driving. Finally, this study compared current residents in different neighborhoods. A research design that follows study participants as they move to

different types of urban environments, or before and after pedestrian improvements are made, may produce more conclusive results on the impact of the built environment on walking and on health. Such research is now being supported through the Robert Wood Johnson Foundation project, Active Living Research, administered by San Diego State University.

### **What these findings mean for public policy**

#### *Improve the balance of homes, shops, offices, and institutions*

This study found that land use mix is the most important neighborhood characteristic associated with obesity. According to this model, a change in the balance of land use mix from .15 to .30 would reduce the probability of obesity by 5 percent across the region. While this may seem modest, it is comparable to magically making everyone in the region 5 years younger.

Increasing the mix of uses in the Atlanta region is not a radical change. While it would triple the number of businesses near homes, the number of development parcels dedicated to business uses would be less than ten percent the number of plots devoted to homes. The Atlanta region is also beginning with an extraordinarily low degree of land use mix, with its average balance of uses of .15 on the zero-to-1 scale. Other regions tend to have a more balanced mix.

Cities and counties can begin to improve the balance of uses in their neighborhoods through zoning changes and easing the approval of innovative mixed-use developments. Several such projects are already underway in the Atlanta region; the largest is Atlantic Station, a development that includes homes, offices, and shopping on the site of an old steel mill in the heart of the city.

#### *Provide opportunities to get out of the car*

The study found that another avenue for reducing the likelihood of obesity may be to spend less time in an automobile. The average person in the study spent an hour a day in a car, and a few respondents spent as much as five hours a day as drivers or passengers. Most of that driving was probably necessary travel: going to work, running errands, or shopping, and much of it was undoubtedly out of reach via foot, bicycle, or transit.

Policy makers can help get more people on their feet by increasing destinations within walking distance, as discussed above. It is also important to make walking and bicycling safe and convenient: this

means building 'complete streets' that include sidewalks, bike lanes, and other facilities. Several states, including California and Virginia, have adopted complete streets policies for all future road construction and improvement projects. Health and Human Services Secretary Tommy Thompson recently called for complete streets to fight the obesity epidemic, saying, ""Every road being built — you should be able to walk on it or ride a bike on it."

Another important policy to help people drive less is to provide strong support for public transit, which vastly extends the distances people can travel without a car. Data from the SMARTRAQ study in Atlanta shows that three out of every four trips on rail transit began and ended on foot. Transit riders are walkers and walkers are transit users.

*Increase opportunities to walk*

The research shows that increasing the average distance walked for all residents by about 1 kilometer a day could significantly reduce the probability of obesity. The US Surgeon General recommends getting 30 minutes of moderate physical activity five days a week; walking two kilometers takes about that long. However, more than 90 percent of study participants did not report walking at all.

The good news is that studies show that even very modest activity will bring health benefits to completely sedentary people. Education programs that encourage active living can help many people take advantage of these benefits. New programs such as Active Living By Design are helping re-make communities into places where physical activity is an easy choice. By providing people with better places to walk and places to walk to, public health officials and policy makers can get more Americans on their feet in the fight against the obesity epidemic.

*For More Information:*

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